INDOOR AIR QUALITY
POST-OCCUPANCYASSESSMENT

Executive Office of Health and Human Services
Service Center
49 Nursery Lane
Fitchburg, MA

Prepared by:
Massachusetts Department of Public Health
Bureau of Environmental Health
Indoor Air Quality Program
November 2018

Background

Building:	Executive Office of Health and Human Services (EOHHS) Center
Address:	49 Nursery Lane (Formerly Nockage Street) Fitchburg, MA
Assessment Requested by:	Jamie Blood, Regional Planner/Project Manager, Division of Capital Asset Management and Maintenance (DCAMM)
Reason for Request:	Post-occupancy indoor air quality (IAQ) assessment
Date of Assessment:	November 20, 2018
Massachusetts Department of Public Health/Bureau of Environmental Health (MDPH/BEH) Staff Conducting Assessment:	Ruth Alfasso, Environmental Engineer/Inspector, IAQ Program
Building Description:	Two-story brick building originally constructed around 1900 as a factory. It was completely remodeled prior to occupancy by the EOHHS center.
Building Population:	Approximately 150 employees in Department of Children and Families (DCF), Department of Developmental Services (DDS), Department of Transitional Assistance (DTA), and the Massachusetts Rehabilitation Commission (MRC).Members of the public visit daily.
Windows:	Not openable

Methods

Please refer to the IAQ Manual for methods, sampling procedures, and interpretation of results (MDPH, 2015).

IAQ Testing Results

The following is a summary of indoor air testing results (Table 1).

- ***Carbon dioxide levels*** were below the MDPH guideline of 800 parts per million (ppm) in most of the areas assessed, with some levels slightly above, indicating adequate fresh air for most of the space.
- ***Temperature*** was within or very close to the recommended range of 70°F to 78°F.
- ***Relative humidity*** was below the recommended range of 40% to 60% in all areas assessed the day of the assessment.
- ***Carbon monoxide*** levels were non-detectable (ND) in all indoor areas assessed.
- ***Fine particulate matter (PM2.5)*** concentrations measured were below the National Ambient Air Quality Standard (NAAQS) level of 35 $\mu g/m^3$ in all but one area assessed, due to a scented item.

Ventilation

A heating, ventilating, and air conditioning (HVAC) system has several functions. First it provides heating and, if equipped, cooling. Second, it is a source of fresh air. Finally, an HVAC system will dilute and remove normally occurring indoor environmental pollutants not only by introducing fresh air, but also by filtering the airstream and ejecting stale air to the outdoors via exhaust ventilation. Even if an HVAC system is operating as designed, point sources of respiratory irritation may exist and cause symptoms in sensitive individuals. The following analysis examines and identifies components of the HVAC system and likely sources of respiratory irritant/allergen exposure from water damage, aerosolized dust, and/or chemicals found in the indoor environment.

Fresh air is provided by air-handling units (AHUs) located on the roof. Operation of the building's HVAC system is controlled by an automated computer system. Air from the AHUs is filtered, heated/cooled, and delivered to rooms via ducted supply vents (Picture 1). Air is returned/exhausted through return vents. It is recommended that HVAC systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994). It was reported that the system was balanced prior to occupancy. It was reported that exhaust vents in the restrooms and kitchen areas vent directly outside. Direct-vented exhaust is recommended in areas where moisture and odors may be generated.

In a few offices, there was tape over the supply vents (Picture 2). Vents should remain unobstructed for proper airflow once the system has been balanced. If this tape is in response to

concerns about drafts, building maintenance staff should be contacted for adjustments of the system. Also note that offices with windows were frequently noticeably cooler than those in the interior during the assessment. Few, if any, thermostats for were found in exterior offices, so the system may not properly account for temperature differences between interior and exterior offices. If occupants express concerns about temperature in the exterior offices, additional thermostats should be located there and the computer system adjusted to supply more heat to those offices.

Microbial/Moisture Concerns

Several water coolers were located in carpeted areas (Picture 3). Spills or leaks from these appliances can moisten the carpet, leading to odors and microbial growth.

Plants were present in some areas (Picture 4; Table 1). Plants can be a source of pollen and mold, which can be respiratory irritants to some individuals. Plants should be properly maintained and equipped with drip pans to prevent water damage to porous materials. Plants should also be located away from air diffusers to prevent the aerosolization of dirt, pollen, and mold.

During the pre-occupancy visit, stained ceiling tiles from a roof leak were noted on the second floor. During the post-occupancy visit, building staff reported that a leak in the same area had occurred since the building was occupied; the roof was since repaired and all the stained tiles were replaced. No water-damaged ceiling tiles or other materials were noted during the post-occupancy visit.

The building has a crawlspace access door in the stairwell that lacked weather-stripping (Picture 5), which can allow odors and pests to migrate into occupied areas. Other doors between occupied and unconditioned spaces, including outdoors, should be rendered tight using weather-stripping, and kept closed.

Other IAQ Evaluations

Exposure to low levels of total volatile organic compounds (TVOCs) may produce eye, nose, throat, and/or respiratory irritation in some sensitive individuals. To determine if VOCs were present, BEH/IAQ staff examined rooms for products containing VOCs. BEH/IAQ staff noted dry erase markers, cleaning products, air freshening products and hand sanitizers in use

within the building (Pictures 6 and 7; Table 1). All of these products have the potential to be irritants to the eyes, nose, throat, and respiratory system of sensitive individuals. The scented items in one office may be responsible for the elevated level of PM2.5 found there (Table 1).

Several storage areas had slight odors. In two of these rooms, wooden built-in shelves (Picture 8) had been sealed with a lacquer material that seemed to be the source of the odor. This odor should dissipate as the material finishes off-gassing, but this can be sped up by increasing ventilation when possible. If odors persist, it may help to wash the shelving with a mild detergent and allow to dry fully. Odors in another storage room seemed to be from some of the stored materials. Boxes containing printed materials or plastic items should be kept closed when not in use to minimize off-gassing.

Several office areas had food in them (Table 1). Food should be stored in tightly-sealed containers to prevent odors and pests, particularly since rodents had been observed in the building. Kitchen equipment such as toasters, microwaves, and refrigerators should also be cleaned regularly.

In a few areas, boxes and other items were stored on the floor. Also note that the arrangement of cubicles in one section of the office creates an aisle next to the windows (Picture 9). Areas like this tend to attract clutter and may not be effectively cleaned, which creates harborage for pests. In general, excessive stored materials and accumulated items make it more difficult for custodial staff to clean (Table 1). Items should be stored neatly and moved periodically to allow for wet-wiping and vacuuming of surfaces.

Many offices are carpeted. Carpets should be cleaned annually (or semi-annually in soiled/high traffic areas) in accordance with Institute of Inspection, Cleaning, and Restoration Certification (IICRC) recommendations (IICRC, 2012).

Conclusions/Recommendations

Based on observations at the time of assessment, the following is recommended:

1. Operate supply and return ventilation continuously (“fan on”) during occupied periods.
2. Remove tape from vents.
3. Have the HVAC system balanced every 5 years in accordance with SMACNA recommendations (SMACNA, 1994).

4. If temperatures in exterior offices are not comfortable, consider adding thermostats to better represent conditions in those areas.
5. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, a high efficiency particulate arrestance (HEPA) filter equipped vacuum cleaner in conjunction with wet wiping of all surfaces is recommended. Avoid the use of feather dusters. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).
6. Monitor any areas where building envelope leaks have occurred and ensure there is a system for prompt reporting.
7. Place refrigerators and water dispensing equipment in areas without carpeting or use a waterproof mat underneath them.
8. Keep plants in good condition, avoid overwatering, and avoid placing them on porous items such as carpets or paper.
9. Ensure all doors between occupied and unconditioned spaces are sealed with weather-stripping and kept closed.
10. Reduce use of cleaning products, sanitizers, and scented products.
11. Ventilate storerooms to reduce lacquer odors from shelving; wash shelving if needed.
12. Ensure boxes of printed and plastic-containing materials are kept closed when not in use.
13. Keep food in tightly sealed containers and keep kitchen equipment clean.
14. Store items in an organized manner and off the floor. Move items periodically to allow for cleaning, including vacuuming and wet wiping of surfaces to remove dust. Ensure that areas like that shown in Picture 9 are a regular part of the cleaning program.
15. Clean carpeting in accordance with IICRC recommendations (IICRC, 2012).
16. Clean supply and exhaust vents, personal fans, and heaters regularly to prevent aerosolization of debris.
17. Refer to resource manual and other related IAQ documents located on the MDPH's website for further building-wide evaluations and advice on maintaining public buildings. These documents are available at: http://mass.gov/dph/iaq.

References

IICRC. 2012. Institute of Inspection, Cleaning and Restoration Certification. Carpet Cleaning: FAQ.

MDPH. 2015. Massachusetts Department of Public Health. Indoor Air Quality Manual: Chapters I-III. Available at: http://www.mass.gov/eohhs/gov/departments/dph/programs/environmental-health/exposure-topics/iaq/iaq-manual/.

SMACNA. 1994. HVAC Systems Commissioning Manual. 1st ed. Sheet Metal and Air Conditioning Contractors' National Association, Inc., Chantilly, VA.

Picture 1

One style of supply vent in the office

Picture 2

Tape on supply vent

Picture 3

Water cooler on carpet

Picture 4

Plants in the office

Picture 5

Space under door to crawlspace from stairwell

Picture 6

Cleaning products

Picture 7

Scented candle

Picture 8

Built-in shelving with lacquer odor and items which can also be sources of odors

Picture 9

Aisle between cubicle walls and windows

Location: EOHHS Service Center **Indoor Air Results**

Address: 49 Nursery Lane, Fitchburg **Table 1** **Date: 11/20/2018**

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 (µg/m^3)	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
Background	421	ND	~32	29	1					Snow and rain
DTA										
Reception	729	ND	72	31	ND	3	N	Y	Y	PC
Lobby/waiting	666	ND	71	29	ND	3	N	Y	Y	
1024-1029 cubes	861	ND	72	28	ND	1	N	Y	Y	PF, PC in hallway
1031-1036 cubes	756	ND	73	27	ND	5	N	Y	Y	HS, decorative items, plants
1061-1066 cubes	759	ND	74	27	1	3	N	Y	Y	PF, CP, HS
1067-1072 cubes	797	ND	74	26	1	2	N	Y	Y	PF, plant
1079-1084 cubes	731	ND	74	25	3	3	N	Y	Y	HS
1037-1041 cubes	776	ND	73	27	1	4	N	Y	Y	Plants

ppm = parts per million
µg/m^3 = micrograms per cubic meter
ND = non detect
AP = air purifier
CP = cleaning products
DEM = dry erase materials
DO = door open
HS = hand sanitizer
MT = missing tile
NC = not carpeted
PC = photocopier
PF = personal fan

Comfort Guidelines

Carbon Dioxide: < 800 = preferable
> 800 ppm = indicative of ventilation problems

Temperature: 70 - 78 °F
Relative Humidity: 40 - 60%

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Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 (µg/m^3)	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
1005	691	ND	71	30	ND	1	N	Y	Y	
1006	615	ND	71	28	ND	0	N	Y	Y	Training room, NC
1007 cube area	640	ND	72	29	ND	4	N	Y	Y	NC
1008	637	ND	71	28	ND	1	N	Y	Y	NC, PC
1009 interview	618	ND	72	27	ND	0	N	Y	Y	NC
1010	597	ND	71	26	ND	0	N	Y	Y	NC
1013	608	ND	71	26	ND	0	N	Y	Y	NC
1014	711	ND	71	26	ND	0	N	Y	Y	NC, tape on vent
1015	661	ND	71	27	1	0	N	Y	Y	NC, tape on vent
1017	691	ND	71	29	ND	0	N	Y	Y	NC
1018	787	ND	71	27	ND	0	N	Y	Y	NC, boxes on floor

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								Supply	Exhaust	
1019	812	ND	71	27	ND	0	N	Y	Y	NC
1020	746	ND	71	28	6	0	N	Y	Y	NC, HS
1021	658	ND	71	27	ND	0	N	Y	Y	
1022	662	ND	71	27	ND	0	N	Y	Y	
1023 kitchen	755	ND	72	32	ND	2	N	Y	Y	Plants, fridges, microwave
1042 half-wall	745	ND	73	27	1	1	N	Y	Y	PC in hallway, DO
1043 half-wall	747	ND	74	27	1	1	N	Y	Y	
1045 conference	637	ND	74	25	1	0	N	Y	Y	
1046	810	ND	72	25	ND	0	N	Y	Y	Feels colder in here, next to window
1048	766	ND	69	36	5	1	N	Y	Y	
1050 half wall	727	ND	73	21	ND	0	N	Y	Y	

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								Supply	Exhaust	
1051 half-wall	738	ND	73	27	ND	0	N	Y	Y	
1052 half-wall	839	ND	74	26	2	1	N	Y	Y	
1057 half-wall	779	ND	74	26	1	0	N	Y	Y	
1058 half-wall	751	ND	74	26	1	1	N	Y	Y	
1059 half-wall	862	ND	74	26	3	1	N	Y	Y	
1060	736	ND	74	26	1	0	N	Y	Y	HS
1085	737	ND	71	32	ND	0	N	Y	Y	
1073 – 1078 cubes	741	ND	74	26	2	3	N	Y	Y	
DMH										
Reception	693	ND	71	27	2	1	N	Y	Y	

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								Supply	Exhaust	
Lobby Conference for DMH, MRC, DDS	682	ND	71	26	1	0	N	Y	Y	NC
Waiting area for DMH, MRC, DDS	642	ND	71	26	1	0	N	Y	Y	NC
1095-1102 cubes	766	ND	72	27	1	0	N	Y	Y	Plants
1091-1094 cubes	720	ND	73	26	1	0	N	Y	Y	PC
1103-1106 cubes	789	ND	72	26	1	2	N	Y	Y	HS, plants
1040	632	ND	72	25	ND	0	N	Y	Y	
1088	738	ND	73	26	1	6	N	Y	Y	Plant
1089	767	ND	73	26	3	1	N	Y	Y	Fridge, items on windowsill, DEM
1108	742	ND	72	26	1	0	N	Y	Y	DEM

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								Supply	Exhaust	
1109	712	ND	73	25	ND	0	N	Y	Y	DEM, PC, fabric on window
1110	708	ND	72	26	ND	0	N	Y	Y	Scented item, AP, DEM
1111 stationery storage	604	ND	72	26	ND	0	N	Y	Y	Odor (coating on built in shelves?), stored items including paper and CP
1112	676	ND	71	26	ND	0	N	Y	Y	Storage, including boxes on floor
1114	660	ND	72	26	1	0	N	Y	Y	Shredder and printer
1115	551	ND	72	26	ND	0	N	Y	Y	Rubber odor, stored files in boxes
1116	715	ND	74	25	1	0	N	Y	Y	NC, kitchen items
MRC										
1142	664	ND	71	26	1	0	N	Y	Y	NC
1143	600	ND	71	27	ND	0	N	Y	Y	NC
1146	562	ND	72	25	ND	0	N	Y	Y	

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								Supply	Exhaust	
1147	609	ND	70	25	1	0	N	Y	Y	MT
1148	954	ND	71	28	1	0	N	Y	Y	NC
1149 interview	601	ND	71	26	ND	0	N	Y	Y	NC
1150	548	ND	73	26	ND	0	N	Y	Y	NC
Security area	613	ND	74	26	1	2	N	Y	Y	Feels warmer in here, NC, CP, HS
Second Floor – DDS										
Second floor women's restroom							N	Y	Y	Shared with other tenant
Second floor men's restroom							N	Y	Y	Shared with other tenant
2015-2022 cubes	691	ND	70	28	2	1	N	Y	Y	Plants
2040-2045 cubes	702	ND	70	28	2	5	N	Y	Y	Food

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								Supply	Exhaust	
2007-2012 cubes	712	ND	70	28	2	3	N	Y	Y	
2037-2040 cubes	685	ND	70	27	2	5	N	Y	Y	Cloth, items
2032-2034 cubes	667	ND	71	26	1	0	N	Y	Y	
2025-2027 cubes	680	ND	70	28	1	2	N	Y	Y	Plants
2000	732	ND	70	29	36	1	N	Y	Y	Food, salt lamp, plants, scented item
2001	759	ND	70	28	3	1	N	Y	Y	DEM, AP, PF, plants
2003	701	ND	70	28	1	0	N	Y	Y	Food
2004	807	ND	70	28	0	2	N	Y	Y	Salt lamp, scented candle (unlit)
2006 cube	972	ND	71	29	3	1	N	Y	Y	Water cooler on carpet
2012	661	ND	70	28	8	0	N	Y	Y	Copy room, NC

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								Supply	Exhaust	
2016	829	ND	70	30	1	Group just left	N	Y	Y	
2017	689	ND	70	29	1		N	N	N	Storage – shellac or paint odor from shelving, NC
2020 kitchen	725	ND	70	30	1	0	N	Y	Y	NC, toaster, refrigerator, ducted exhaust reported
2028	710	ND	70	28	2	1	N	Y	Y	MT, food
2029	714	ND	70	28	1	0	N	Y	Y	DO
2030	660	ND	70	27	1	0	N	Y	Y	Heater, decorative items
2031	644	ND	70	26	1	0	N	Y	Y	
Elevator lobby	619	ND	71	27	1	0	N	Y	Y	NC and walk off carpets

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